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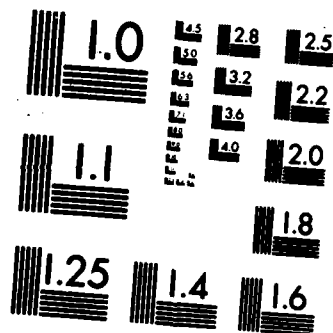
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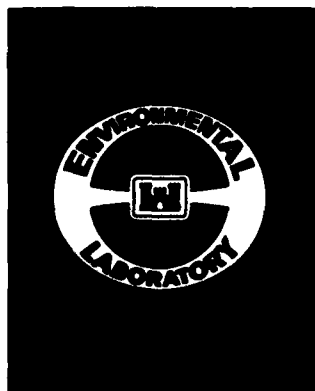


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**ENVIRONMENTAL IMPACT
RESEARCH PROGRAM**

TECHNICAL REPORT EL-86-50

STEEP-SLOPE SEEDER

Section 8.4.6, US ARMY CORPS OF ENGINEERS
WILDLIFE RESOURCES MANAGEMENT MANUAL

by

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<p>→ An equipment report on steep-slope seeders is provided as Section 8.4.6 of the US Army Corps of Engineers Wildlife Resources Management Manual. The report is designed to assist the Corps District or project biologist with the selection and use of types of equipment and materials available for habitat development and manipulation. Topics covered include description, operation and maintenance, limitations, and availability.</p> <p>The steep-slope seeder consists of a telescoping boom crane and seeding apparatus developed for establishing vegetation on steep, unstable slopes. Management objectives for using steep-slope seeders are stated, and application to habitat development projects is discussed. The design and assembly of equipment are described and illustrated, and general specifications are provided. Methods of operation are described, and maintenance and safety requirements are given. Appropriate cautions and limitations are discussed. <i>Key words</i></p>					
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PREFACE

This work was sponsored by the Office, Chief of Engineers (OCE), US Army, as part of the Environmental Impact Research Program (EIRP), Work Unit 31631, entitled Management of Corps Lands for Wildlife Resource Improvement. The Technical Monitors for the study were Dr. John Bushman and Mr. Earl Eiker, OCE, and Mr. Dave Mathis, Water Resources Support Center.

This report was prepared by Mr. Ted B. Doerr, Range Science Department, Colorado State University, Fort Collins, Colo. Mr. Doerr was employed by the Environmental Laboratory (EL), US Army Engineer Waterways Experiment Station (WES), under an Intergovernmental Personnel Act contract with Colorado State University during the period this report was prepared. Mr. Chester O. Martin, Team Leader, Wildlife Resources Team, Wetlands and Terrestrial Habitat Group (WTHG), EL, was principal investigator for the work unit. Mr. Dan W. McKenzie, USDA Forest Service, Equipment Development Center, San Dimas, Calif., provided equipment specifications and photographs used in the report. Review and comments were provided by Mr. Martin, WES, and Mr. Larry E. Marcy, Texas A&M University.

The report was prepared under the general supervision of Dr. Hanley K. Smith, Chief, WTHG, EL; Dr. Conrad J. Kirby, Chief, Environmental Resources Division, EL; and Dr. John Harrison, Chief, EL. Dr. Roger T. Saucier, WES, was Program Manager, EIRP. The report was edited by Ms. Jessica S. Ruff of the WES Information Products Division (IPD). Drawings were prepared by Mr. John R. Harris, Scientific Illustrations Section, IPD, under the supervision of Mr. Aubrey W. Stephens, Jr.

COL Allen F. Grum, USA, was the previous Director of WES. COL Dwayne G. Lee, CE, is the present Commander and Director. Dr. Robert W. Whalin is Technical Director.

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NOTE TO READER

This report is designated as Section 8.4.6 in Chapter 8 -- EQUIPMENT, Part 8.4 -- DRILL AND BROADCAST SEEDERS, of the US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL. Each section of the manual is published as a separate Technical Report but is designed for use as a unit of the manual. For best retrieval, this report should be filed according to section number within Chapter 8.

STEEP-SLOPE SEEDER

Section 8.4.6, US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL

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The steep-slope seeder was developed by the USDA Forest Service to effectively establish vegetation on steep, unstable slopes (USDA Forest Service 1982). It is designed to simultaneously scarify, seed, and fertilize slopes where heavy equipment cannot safely operate. This seeder provides better soil coverage of seed and a firmer seedbed than does broadcast seeding. Studies in Idaho indicated that better seed germination and plant survival were obtained using the seeder compared to hydroseeding and broadcasting (USDA Forest Service 1979). The steep-slope seeder has application for seeding roadsides, cuts and fills, dam faces, and surface mine disturbances where slopes range from 45 to 75 deg (Larson 1980). The seeder has been successfully tested on clay and sandy soils in the Pacific Northwest.

DESCRIPTION

The steep-slope seeder is composed of a large, self-propelled, telescoping boom crane and the seeding apparatus (Fig. 1). Recommended cranes include Droft-Cruz-Air Model 40 and Warner and Swasey Gradall Models G-660, G-800, and G-1000 (USDA Forest Service 1979, Larson 1980). The seeder is built on a frame (10.5 ft long by 6 ft wide) that is supported by wheels and the crane. One row of individually spring-loaded tynes is at the front of the frame followed by 1 or 2 rotary seeders (USDA Forest Service 1979, Larson 1980). A second row of flexible tynes is attached behind the seeders, and spring-loaded press wheels are located at the rear of the frame (Fig. 2). The steep-slope seeder handles seed ranging in size from 0.01 to 0.32 in. Other specifications are provided in Table 1.

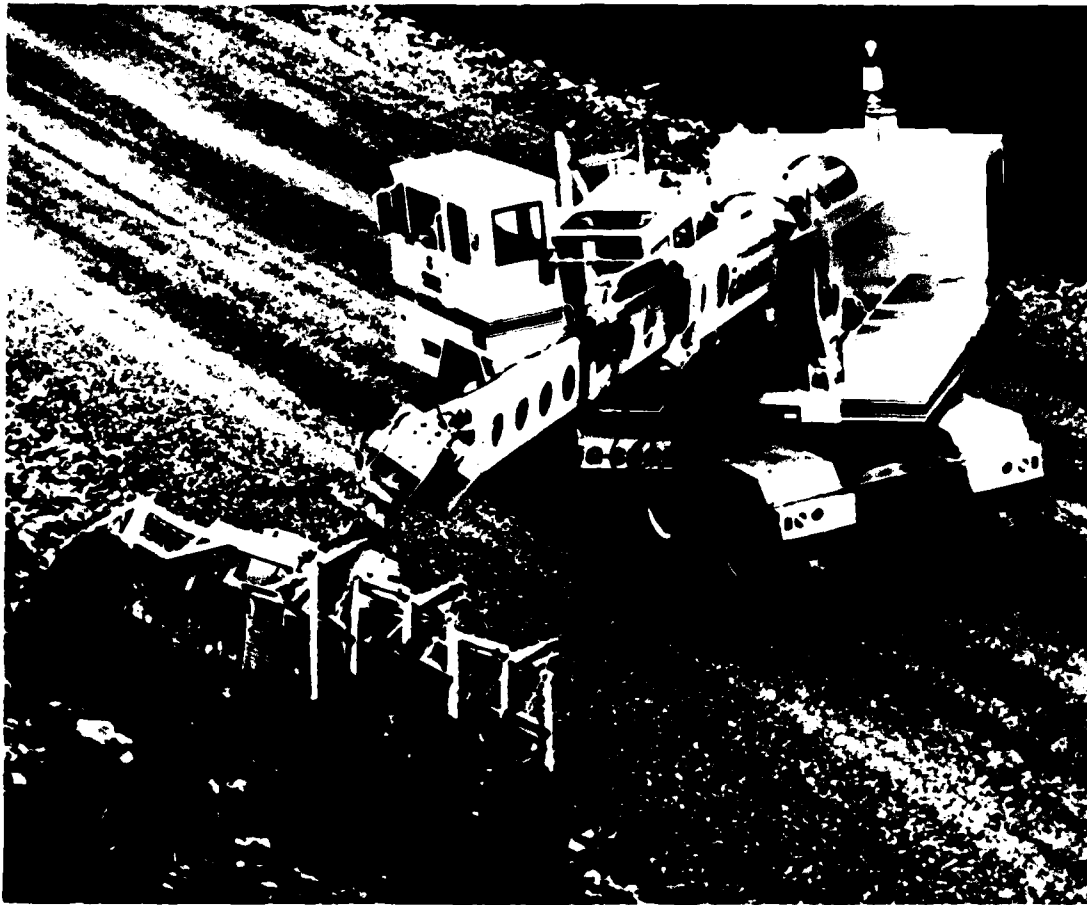


Figure 1. Steep-slope seeder in operation on a cut bank (photo courtesy Dan W. McKenzie, USDA Forest Service)

Table 1. General steep-slope seeder specifications

<u>Feature</u>	<u>Specification</u>
Working width	6 ft
Hopper capacity	2 cu ft
Seeder weight	1700 lb
Maximum reach	54 ft
Seeding rates	5-60 lb/ac

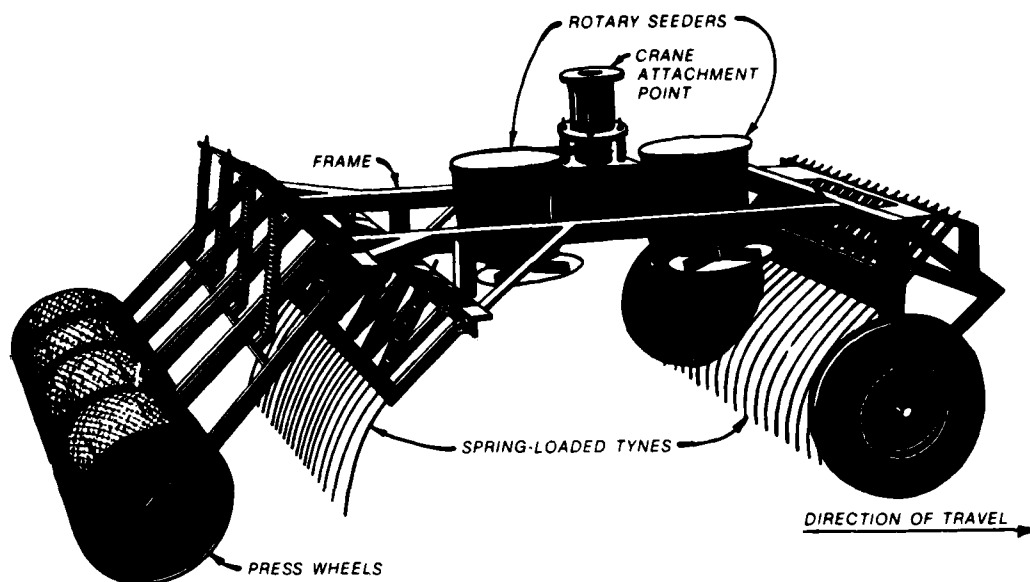


Figure 2. Diagram of steep-slope seeder showing tynes, press wheels, and rotary seeders

OPERATION AND MAINTENANCE

The steep-slope seeder is lifted over the treatment area by the crane and gently lowered onto the soil surface. The crane can rotate the seeder 180 deg; therefore, the seeder can efficiently seed long areas by reversing direction of travel and rotating the seeder (USDA Forest Service 1979). The seeder is usually operated at speeds less than 4 mph and can seed approximately 2 acres/hour (Larson 1980). Little site preparation is required prior to seeding because the tynes and press wheels can articulate over debris, which reduces the erosion hazard. During operation, the front tynes break up soil clods, loosen the soil surface to a depth of 0.5 in., and create small furrows (USDA Forest Service 1979, Larson 1980). The rear tynes are used to cover the seed with soil, and the press wheels firm the soil to provide better seed-soil contact. A comparison of the steep-slope seeder with three other methods of seeding on slopes showed that the germination, survival, and growth rates for seed planted by the seeder were very high (Table 2) (USDA Forest Service 1979).

Steep-slope seeder tynes, press wheels, and the frame should be checked for breakage, excessive wear, or loose bolts, and repairs should be made prior

Table 2. A comparison of the effectiveness of 4 seeding methods used on slopes (USDA Forest Service 1979)

Seeding Method	Plants per 1 sq m (10.8 sq ft) plot	Percent Ground Cover Attained
Hydroseed with Silva fiber mulch	30	20
Broadcast (hand-scattered)	42	37
Broadcast with straw mulch and jute netting	60	31
Steep-slope seeder	80	43

to use. Moving parts and springs should be lubricated periodically. Vehicle and crane maintenance should follow manufacturers' specifications.

LIMITATIONS

The steep-slope seeder is custom built and is not commercially available (Larson 1980). The equipment cost is high (\$4500) (USDA Forest Service 1979), and heavy slash will substantially slow seeding efforts and double the cost of use. The seeder should not be pushed backwards or pulled sideways and must be set down gently to avoid excessive breakage (USDA Forest Service 1979).

AVAILABILITY

Design drawings and specifications are available from:

USDA Forest Service
Equipment Development Center
444 E. Bonita Ave.
San Dimas, California 91773

LITERATURE CITED

Larson, J. E. 1980. Revegetation equipment catalogue. USDA For. Serv. Equipment Development Center, Catalogue No. 8042 2501. 198 pp.

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